Name:

UIN:

**Signature**:

:

1. This is a closed book examination, However you may use the cheat sheet provided to you and the z tables. You should have no other printed or written material with you on the exam. But scrap paper is allowed.

2. You have 60 minutes to work on this exam. There are **15** multiple choice questions.

3. You may use a calculator in the exam.

4. If there is no correct answer or if multiple answers are correct, select the **best** answer.

5. If you are unsure of what a question is asking for, do not hesitate to ask the instructor for clarification (however we are limited in the amount of help we can offer).

6. Good Luck!!!

(1) Below is the QQplot of the weight of 44 two week old calves.
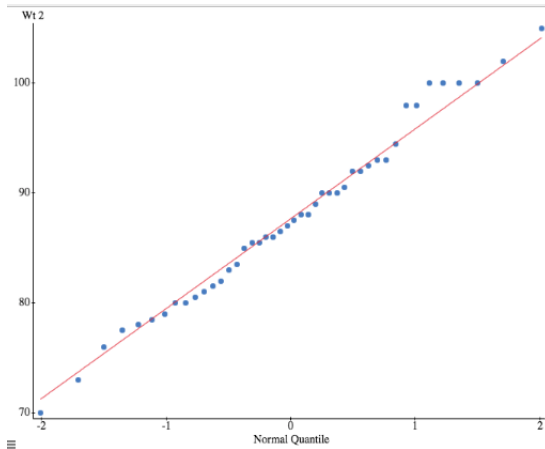
Which statements(s) best describe the data?

(A) There is linear dependence between the two variables.

½ (B) The horizontal dots mean some weights are the same.

½ (C) The weights appear to be relatively close to normal, with a small deviation from normality in the tails.

(D) (B) and (C).

(E) (A) and (B).

(2-5) The grades in an exam are **normally distributed** with a (population) mean $\mu = 1100$ and (population) standard deviation $\sigma = 200$.

(2) What proportion of students who take this exam will score between **1200-1400**?

(A) 15%   (B) 85%   (C) 24%   (D) 93%   (E) 1%

(3) A class of **16** students take the exam. What is the distribution of the average (sample mean based on 16) score?

(A) **Normal** with mean $\mu = 1100$ and standard error $\frac{200}{\sqrt{16}}$

(B) **Slightly right skewed** with mean $\mu = 1100$ and standard error $\frac{200}{\sqrt{16}}$

(C) **Normal** with unknown mean and unknown standard error.

(D) **Right skewed** with unknown mean and unknown standard error.

(E) **Normal** with mean $\mu = 1100/\sqrt{16}$ and standard error $200/\sqrt{16}$.

(4) What is the chance that the class average (based on **16** students) will be between **1200** to **1250**?

(A) 45%   (B) 25%   (C) 8.2%   (D) 2.1%   (E) 1%.

2

(5) The chance that the average grade in a class of 16 (taught in person) is **950 or below** is 0.13%

To understand the impact that online classes have on students learning, 16 students **were randomly selected** and taught using zoom for one year (no in person teaching). The average grade in this online class was less than 950. What do the results from the study suggest?

(A) It is clear that online learning has a detrimental impact on learning outcomes.

(B) The probability of this happening by chance is small (0.13%), which suggests that online learning may have a negative impact on learning outcomes.

(C) The data is not very conclusive about the impact of online learning.

(D) There is a selection bias in the results.

(E) [B] and [D].

(6) The 95% confidence interval for the mean based on a sample of size 50 is $[10, 20]$. What is the minimum sample size required to reduce the margin of error to 1?

(A) 250   (B) 500   (C) 750   (D) 1250   (E) 1500.

(7) The distribution of STAT303 grades is highly **left** skewed. The mean grade is 80% and the standard deviation is 15%. **4** students take the example, what is the distribution of their average grade?

(A) **Normal** with mean $\mu = 80$ and standard error $\frac{15}{\sqrt{4}}$

(B) **Left skewed** with mean $\mu = 80$ and standard error $\frac{15}{\sqrt{4}}$

(C) **Normal** with mean $\mu = 80$ and standard error 15.

(D) **Left skewed** with mean $\mu = \frac{80}{\sqrt{4}}$ and standard error $\frac{15}{\sqrt{4}}$.

(E) **Right skewed** with mean $\mu = 80$ and standard error 15.

(8) If the distribution of the original population is normally distributed, then for ____(1)____ sample size the sample mean will be normally distributed.

If the distribution of the original population is **thick** tailed, then for a ____(2)____ sample size the ____(3)____ will be normally distributed.

The standard error of the sample mean is $\sigma/\sqrt{n}$ for ____(4)____ sample sizes.

	(1)	(2)	(3)	(4)
A	any	any	sample	sufficiently large
B	sufficiently large	sufficiently large	sample	all
C	any	sufficiently small	sample mean	sufficiently large
D	any	sufficiently large	sample mean	all
E	sufficiently small	sufficiently large	sample	sufficiently small

3

(9) Based on a survey of 100 students, a 95% confidence interval for the mean time a student spends on their phone in a day is $[1.5, 1.8]$ hours. Which statement is correct about the confidence interval ($\bar{x}$ denotes sample mean and MoE the Margin of Error)?
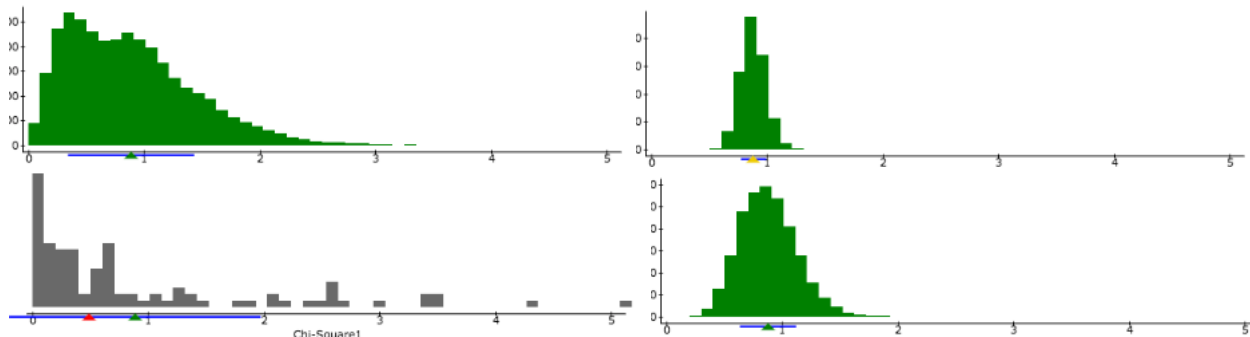
(A) $\bar{x} = 1.5$ and MoE $= 0.3$ [(B)] $\bar{x} = 1.8$ and MoE $= 0.3$

(C) $\bar{x} = 1.65$ and MoE $= 0.15$ (D) $\bar{x} = 3.3$ and MoE$=0.3$

(E) $\bar{x} = 1.65$ and MoE $= 0.3$.

(10) Match the sample size to the plot. The population is labelled as original (and distribution is given), further, the distribution of the sample means for the sample sizes $n = 4$, $n = 20$ and $n = 100$ is also given.

Plot numbering: Top Left: (1). Top Right: (2). Bottom Left: (3) and Bottom Right: (4).

	(1)	(2)	(3)	(4)
A	100	20	original	4
B	4	100	original	20
C	original	4	20	100
D	20	original	4	100
E	100	original	20	4

(11) Customers are encouraged to rate customer service at HEB. They can give a rating of **one star**, **two stars** or **three stars**. It is known that the standard deviation of the ratings is $\sigma = \mathbf{1}$. $\mathbf{4}$ customers rate the customer service at HEB. They give an average rating of $\bar{x} = 2.5$. Use the normal distribution to construct a 95% confidence interval for the mean rating over all customers.

(A) $[1.52, 3.48]$ (B) $[1.52, 3]$ (C) $[1.68, 3.32]$ (D) $[0.86, 4.14]$ (E) $[0.86, 3.5]$

(12) Which statement(s) correctly describe the data in (Q11) (above).

1½   (A) The data is numerical discrete.

1½   (B) The sample mean based on the score of four individuals will not be normally distributed.

(C) Since the data is numerically discrete (1,2,3) the sample mean based on four individuals will be very close to normal.
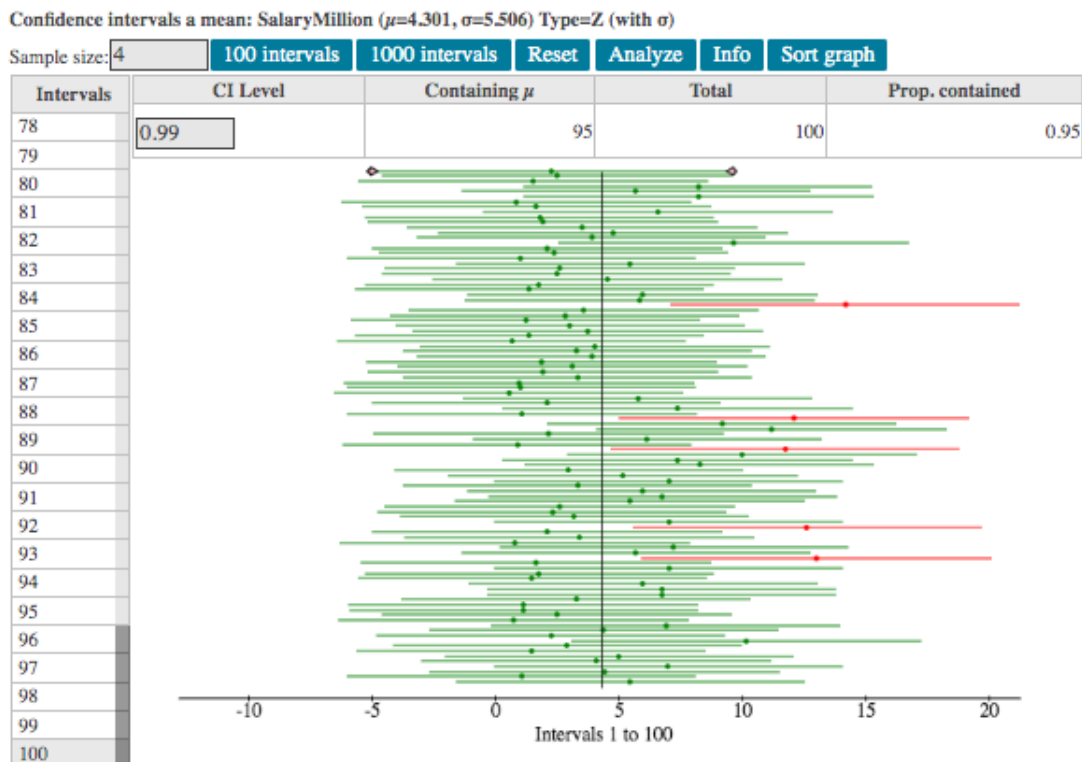
(D) [A] and [B]   (E) [A] and [C].

(13) Below is a plot of the 95% confidence intervals for the efficacy of three different Covid vaccines.
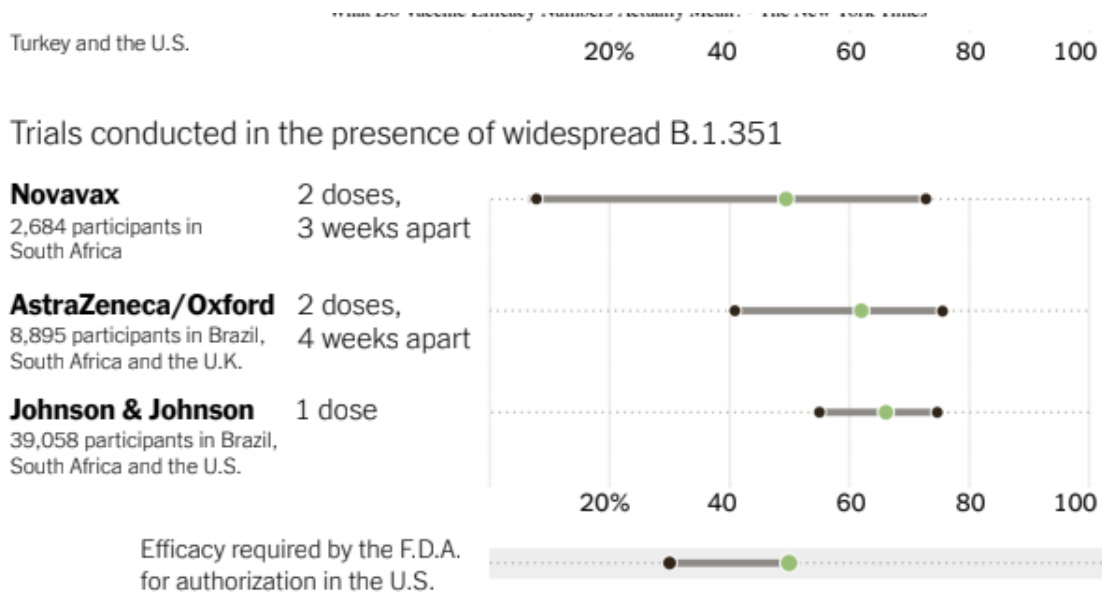
Which statement(s) is correct?

1½   (A) All the confidence intervals overlap, therefore the efficacy of the three different vaccines are indistinguishable.

(B) The data clearly demonstrates that Johnson and Johnson vaccine is the best vaccine of the three.

1½   (C) The wide confidence interval of the Novavax vaccine is due to the **small** sample size.
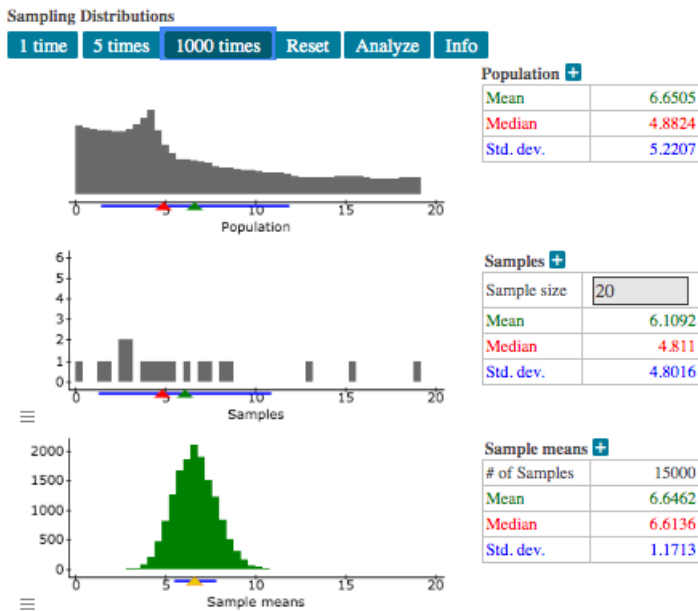
(D) (A) and (C)   [E] None of the above.

(14) To access the reliability of a confidence intervals for right skewed data based on a sample size $n = 4$. Some numerical experiments were run for the **99%** confidence intervals. The plot is on the next page.

Confidence intervals a mean: SalaryMillion (μ=4.301, σ=5.506) Type=Z (with σ)

Sample size: 4 | 100 intervals | 1000 intervals | Reset | Analyze | Info | Sort graph

Intervals	CI Level	Containing μ	Total	Prop. contained
78	0.99	95	100	0.95

Intervals 1 to 100

Based on the plots, which statement(s) is correct?

(A) 95 of the 100 intervals plotted contain the true mean.

(B) The true level of confidence exactly matches the stated level of 99%.

(C) It is clear from the plot that the sample mean is normally distributed.

(D) (A) and (B)   [E] (A), (B) and (C).

(15) Below are three plots and their corresponding summary statistics.

Sampling Distributions

| 1 time | 5 times | 1000 times | Reset | Analyze | Info |

Population ➕

Mean	6.6505
Median	4.8824
Std. dev.	5.2207

Samples ➕

Sample size	20
Mean	6.1092
Median	4.811
Std. dev.	4.8016

Sample means ➕

# of Samples	15000
Mean	6.6462
Median	6.6136
Std. dev.	1.1713

(**1**) Top plot. Histogram for daily rainfall (in mm) (population plot).

(**2**) Middle plot. A histogram for the daily rainfall over 20 days.

(**3**) Bottom plot: The distribution of the sample mean (based on size sample size 20).

Which statement(s) is correct?

(A) The standard error of the sample mean (for $n = 20$) is 1.17.

(B) The standard error of the sample mean (for $n = 20$) is 4.8.

(C) The standard deviation for the daily rainfall is 1.17.

(D) The distribution of daily rainfall is close to normally distributed.

(E) (B) and (D).